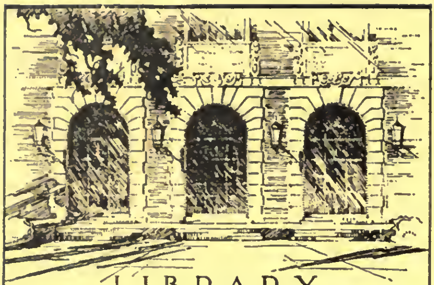

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A GEOGRAPHIC CLASSIFICATION OF NEOTROPICAL MAMMALS

PHILIP HERSHKOVITZ

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A Geographic Classification of Neotropical Mammals

INTRODUCTION

The Neotropical Region and its subdivisions were first defined by Philip Ludley Sclater in 1858. The same faunal areas were redefined by Wallace in 1876 and described in detail by zoogeographers of the late nineteenth and first half of the twentieth century.[1] These authorities recognized four subregions of Neotropica: the Mexican (Middle American), the Antillean (West Indian), the Brazilian, and the Chilean (Patagonian).

Recent additions to our knowledge of the mammals of tropical America indicate a more intimate relationship between the fauna of the northern half of South America and that of southern Mexico and Central America than was suspected by earlier students. These areas are here incorporated as the Middle American Province of the Brazilian Subregion (Table I and map, fig. 7). Except for this modification, the geographic divisions adopted here are essentially those of Sclater and Wallace.

In marked contrast with the above, Schmidt (1954, p. 327) proposed the separation of the Middle American and the West Indian faunal areas from the Neotropical Region and their association with the Holarctic Region. This shift was based on geological considerations, on faunal relationships during the Tertiary, and on the assumption that the "Holarctic relation of the West Indies is strongly supported by their mammalian fauna, fossil and recent." Simpson (1956, p. 22) restored the Middle American area to Neotropica. Regarding the West Indies, he concluded that their mammalian fauna is more nearly related to the Neotropical Region but that the Greater Antilles should be excluded from the Regional scheme altogether.

One cause for divergent and contradictory points of view regarding the allocation of the faunal areas in question was foreseen by Wallace (1876, **1**:55). He admonished: "Should we ever obtain sufficient information as to the geography and biology of the earth at past epochs we might determine approximately what were the Pliocene and Miocene zoological regions; but any attempt to exhibit all these in combination with those of our own period, must lead to confusion." Another cause for dissension and misunderstanding is the lack of commonly accepted standards, terminologies and definitions. It is necessary, therefore, before analyzing faunal areas, that concepts of areas, faunas and taxa be explained from the zoogeographic point of view.

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[1] For a concise review of the history of zoogeography and an extensive bibliography see Schmidt (1955).

ZOOGEOGRAPHIC REGIONS AND FAUNAS

A zoogeographic area, whether Realm, Region or subdivision thereof, is a faunal district of the world at a stated time in geologic history. All zoogeographic areas are in a constant state of flux. Their geographic limits expand or contract while their faunal composition changes qualitatively and quantitatively. What is now designated the Neotropical Region differs considerably in geography, climate, and faunal content from the area defined by the same geographic coordinates in the Eocene or earlier. The two areas should not be confused by use of identical names for them. The *Recent* Neotropical Region resembles earliest *Tertiary* Neotropica less than it does *Recent* Nearctica or even *Recent* Palearctica. The Recent Neotropical Region was originally, and is now, constituted on the basis of a comparison of its fauna with contemporary faunas of other Regions. The relationship of the Realms, Regions and their major subdivisions discussed in this report is shown in Table I.

The fauna of a Region comprises all animals inhabiting that Region irrespective of the place of origin of each of the species. A species that originated and lives in the Nearctic Region is classified as a Nearctic element. If it extends its range into the Neotropical Region it is still labeled Nearctic but must be counted as a member of the Neotropical fauna as well. If the Nearctic members of the species disappear, the Neotropical survivors are classified as Neotropical elements. Their earlier label as Nearctic is no longer valid except from a historical point of view. If the taxonomic unit under consideration is a polytypic genus, its Neotropical representatives need not be the same as its living Nearctic ones to conserve the label Nearctic for the genus, if this was the Region of origin. In theory, the same reasoning extends to families and higher taxa.

Table I.—ZOOGEOGRAPHIC SCHEME SHOWING RELATIONSHIP OF MAJOR SUBDIVISIONS OF NEOTROPICAL AND HOLARCTIC REGIONS

Realms	*Regions*	*Subregions*	*Provinces*
Arctogaean	Paleotropical	Not defined here	Not defined here
	Holarctic	Palearctic	Not defined here
		Nearctic	Not defined here
Neogaean	Neotropical	Brazilian	Middle American Colombian Guianan Amazonian and others not defined here
		Patagonian	Not defined here
		West Indian	Not defined here
Notogaean	Not defined here		

ZOOGEOGRAPHIC BOUNDARIES

The boundary between adjacent faunal areas is the barrier that prevents a natural and continuous faunal flow from one area to another. Barriers may shift in position, decrease in effectiveness, or disappear altogether. This may result in a mixture of faunas within a restricted zone or the ultimate replacement of the fauna of one area by that of the infiltrating or invading faunas of other areas.

The greater part of the continental boundary between the Holarctic and Neotropical Regions can be pinpointed with precision because of a detailed knowledge of the ecology and the mammals of the crucial areas. The dividing line extends from eastern Tamaulipas south through western Oaxaca (see map, fig. 8). The boundary between the Nearctic and West Indian Subregions runs east across the Gulf of Mexico to the Atlantic through the Straits of Florida. In contrast, little is known of the mammals occurring along much of the boundary between the Brazilian and Patagonian Subregions and the zoogeographic dividing line on the map (fig. 7) is largely arbitrary.

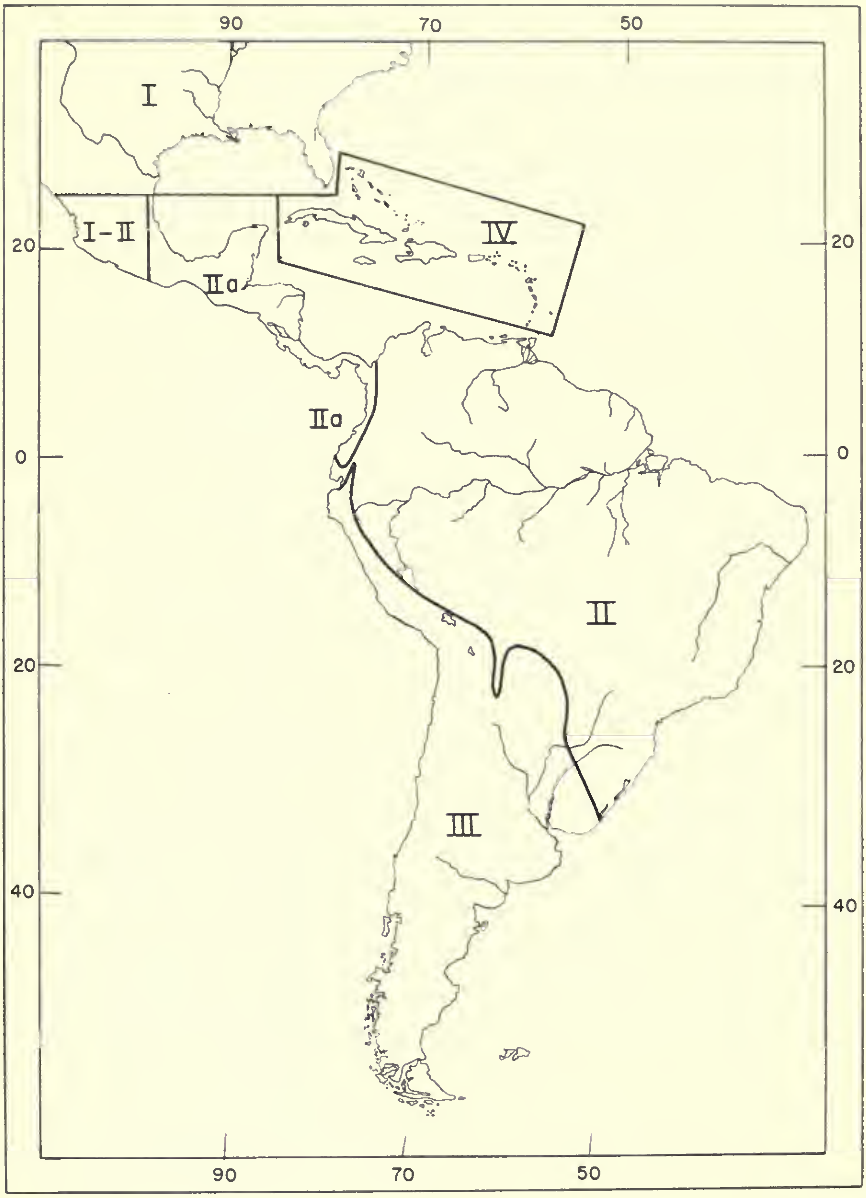

FIG. 7. Map of the Neotropical Region and bordering part of the Holarctic Region. I = Southern part of Nearctic Subregion (Holarctic Region); I–II = Neotropical–Holarctic Transition Zone; II = Brazilian Subregion; II*a* = Middle American Province of the Brazilian Subregion; III = Patagonian Subregion; IV = West Indian Subregion.

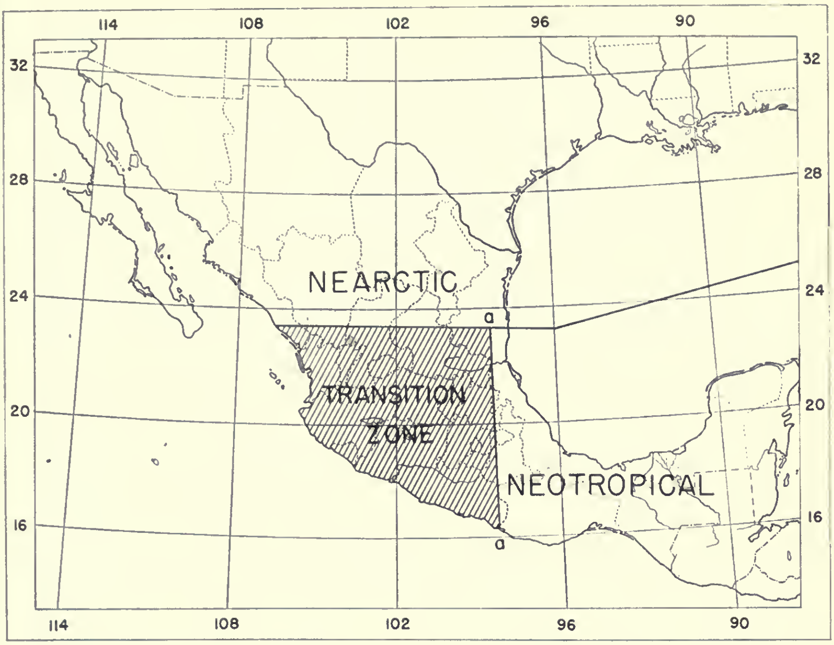

FIG. 8. Map showing the Nearctic (Holarctic)–Neotropical boundary (*a–a*) and the general area of the Holarctic–Neotropical Transition Zone.

ZOOGEOGRAPHIC TRANSITION ZONES

A transition faunal zone generally exists on either side or on both sides of the arbitrarily drawn boundary line between contiguous and contemporaneous faunal areas. The entire fauna of the transition zone is derived from neighboring areas and is usually distributed in a combination of mosaic and interdigital patterns. The habitats of the transition zone are likewise extensions of those of neighboring faunal areas. In the analysis of contiguous and contemporaneous faunal areas, if the organisms of one area range into the transition zone but not beyond into the other area, they are counted as belonging only to the first area.

Coasts and shore lines are transition zones between marine and terrestrial faunal areas.

The transition zone between the Neotropical and Holarctic Regions is the portion of Mexico that lies due west of the interregional boundary (see map, fig. 8). All the Neotropical genera that range west and north into the transition zone but not beyond are counted as belonging to the Neotropical Region only. All Holarctic genera that range south into the transition zone but not beyond are treated as elements confined to the Holarctic Region. Likewise, marine mammals breeding on or visiting coastal transition zones but not habitually foraging on land or in fresh-water streams, are regarded as elements of oceanic regions only.

Other comparably small parts of Middle America may have been transition zones at different times. On the other hand, Schmidt (1954, p. 328) regards all Middle America as a transition zone between the Holarctic and Neotropical Regions. This opinion, based largely on reptiles, is not supported by the mammalian fauna, living or extinct.

GEOGRAPHIC CLASSIFICATION OF MAMMALS

The major regions of the present habitable parts of the earth have been defined in zoogeographic terms that are generally accepted. There is need for an analogous terminology that can be applied uniformly and unequivocably to animals. The terms adopted here for the more important zoogeographic types of non-marine Recent animals are defined as follows.

Cosmopolite: Any taxon whose range includes at least a tropical Region of either the Western or Eastern Hemisphere (i.e., Neotropical or Paleotropical), and a Holarctic (i.e., Nearctic or Palearctic) Subregion of the *other* Hemisphere (cf. Table I).

Insectivora, Chiroptera, Carnivora, Lagomorpha and Rodentia are the most cosmopolitan orders of mammals. Some of their families, for example, Soricidae, Vespertilionidae, Canidae, Leporidae and Sciuridae, respectively, are likewise cosmopolites. In turn, certain genera of these families are also cosmopolites. The insectivore *Sorex,* broadly defined, is found in Paleotropica and Nearctica. Bats of the genus *Myotis* are common in all major zoogeographic regions. The canids *Canis* and *Vulpes* are widespread in the Nearctic and Palearctic Subregions and in the Paleotropical Region. *Sciurus* is the cosmopolite of the squirrel family. There are no cosmopolitan *species* of land mammals other than those whose dispersal was aided by man.

Table X shows the distribution of cosmopolites in the major faunal areas of the Western Hemisphere.

Regionalite: A taxon native to a zoogeographic Region to which it may be confined (*endemic*), or from which it may spread into another, usually contiguous, Region (*excurrent*).

The edentate genus *Dasypus* is a neotropical regionalite, with one of its species, the nine-banded armadillo (*D. novemcinctus*), excurrent into the Nearctic Subregion. All other genera of the edentate Order Xenarthra are endemic Neotropical regionalites, most of them endemic to the Patagonian Subregion.

Table XI lists the 22 Neotropical regionalites excurrent in Nearctica and the 4 Nearctic Subregionalites excurrent in Neotropica.

The distribution, unique among mammals, of the family Tapiridae, poses a problem in geographic classification. Tapirs are now confined to the Paleotropical and Neotropical Regions. In view of their former (Pleistocene) occurrence in northern latitudes of Eastern and Western Hemispheres, the family might be regarded as a cosmopolite. However, in comparing Paleotropica with Palearctica and Neotropica with Nearctica on a generic level, it is logical to treat each genus (or subgenus) of tapirs as an endemic Regionalite of the area it occupies.

Varicant: The name applied to any taxon occurring in contiguous Regions when it cannot be determined with certainty in which Region that taxon originated. A varicant is usually highly tolerant of fluctuating climatic conditions and is well distributed over a large part of each of the Regions it inhabits. The term "varicant," introduced here for the first time, is from the Latin *varicare,* meaning "to straddle."

The monotypic genus *Urocyon,* or gray fox, is a varicant. It ranges as widely in the southern part of the Nearctic Subregion as it does in the northern part of the Neotropical Region. It may have originated in a zone of transition between the two areas or just within the border of either. The polytypic genus *Sylvilagus,* with species of rabbits widely distributed in both Regions, one endemic to the Neotropical Region, others to the Nearctic Subregion, is best classified as a varicant.

Table XII list all varicants of the Western Hemisphere.

Endemic: Any taxon from species to phylum confined to a Region. An endemic is always a regionalite (*q.v.*). The term is not valid for an individual, a local population, a subspecies or any other fraction of a true species.

Table XIII shows the distribution by orders, families, subfamilies and genera in any one Region, Subregion or Province.

Autochthon: A taxon that originated by evolution in a given geographic area. The term is here regarded as strictly synonymous with *native* or *indigene.* As used by Simpson (1953, pp. 32–36), an autochthon may be identical with, more or less than, or quite distinct from, an excurrent, an endemic, or a native. Simpson introduced the term for the purpose of distinguishing between "a group that is merely a native to a region, that is, lives there naturally and not by human introduction or occasional straying, and a group that is autochthonous, that is, originated by evolution in a stated region."

Simpson's distinction between *native* and *autochthonous* is not wholly satisfactory from either the etymological or the historical point of view, and can lead to ambiguous conclusions; for example, Simpson (op. cit., p. 36) regards the genus *Odocoileus* as autochthonous in North America although he states that the family Cervidae is autochthonous in temperate Eurasia only. On the other hand, the genus *Lama,* no less South American in origin than *Odocoileus* is North American, is said to be endemic but not autochthonous in South America because the family Camelidae originated elsewhere.

It is quite correct to regard the Cervidae as autochthonous to Eurasia but only if the Tertiary is specified. It is anachronistic, however, to persist in regarding the family as still autochthonous to Eurasia when organic parts of it have evolved since the Tertiary in North and South America. The family Cervidae is now a cosmopolite. One of its genera, *Odocoileus,* is here regarded as a Neotropical-Holarctic varicant. It may be argued, however, that it is a Nearctic subregionalite excurrent in the Neotropical Region. Another cervid, *Blastocerus,* is a Neotropical endemic and autochthon. The family Camelidae is *now* cosmopolitan. It occurs naturally, that is, it is a native, or autochthon, in a tropical Region of one Hemisphere and in a Subregion of the Palearctic Region of the other Hemisphere. The camelid genus *Lama,* is, and always was, a Neotropical endemic and autochthon.

Visitor: An individual or group of individuals of a given species, with temporary or non-breeding residence in a Region or any of its subdivisions. Many migratory Holarctic birds are *seasonal* visitors in the Neotropical or Paleotropical Region. They may be *incidental* or *accidental* visitors en route. As in the case of birds, migratory mammals (e.g., bats, cetaceans and others) may be regarded as natives of their breeding areas and as visitors in other areas inhabited by them.

Import: The name applied to an individual or group of individuals of a given species introduced into a foreign area through human agency. Domesticated animals and pets, commensal *Rattus* and *Mus*, game and show animals, all enter the category of *import* in localities where they are not native. Insects and parasites are also common imports accidentally introduced by man or his chattel. In many regions the sole or dominant mammals are imports. In a few places, notably islands, imports may have become so well established since prehistoric times that their introduction by aboriginal man is unsuspected or practically impossible to prove. Imports, insofar as they can be recognized, are not taken into account in the definition of a natural faunal area.

ZOOGEOGRAPHIC INDICATORS

Indicators of the geographic limits and affinities of a faunal area at a given time may be any one or more of the taxa living in the area at that time. A species, an order, a class, a phylum, or the entire fauna of an area may serve as an indicator. A Recent faunal area may be compared with another Recent faunal area or with one of the Tertiary, the Jurassic or any other time. On the other hand, a faunal area with indicators selected from two or more geologic time periods is obviously based on anachronisms.

The indicator selected must include all resident members of the designated taxon. If the species is the taxonomic unit employed as indicator, every subspecies and every known individual locality record within the area concerned must be taken into account. If the indicator is the class, every order, family, genus and species must be reckoned. Thus, if Mammalia is the indicator, an analysis of the fauna of the Australian Region and its comparison with other Regions would be absurd if the order Marsupialia were omitted. Omission of the order Chiroptera would wipe New Zealand and many other islands off the zoogeographic map insofar as mammals are concerned. Bats are not only the dominant, and often the sole, indigenous land mammals of a host of islands, but in many tropical areas they exceed all other orders of mammals in numbers of species and individuals, as well. In comparing tropical with temperate zone mammalian faunas, exclusion of bats from the first is not balanced by exclusion of bats from the second. Such omissions result in distorted and sometimes misleading indices of resemblance or relationship. Other orders of mammals may constitute minimal parts of the faunal areas they occupy. Their exclusion from consideration may not always cause the remainder of the fauna to appear pauperized, and may not change, or even obscure, the zoogeographic limits of the areas, but their omission does cause crucial historical events to drop from sight and judgments to be biased.

The preeminently marine Cetacea and Pinnepedia and the sea otter *Enhydra* (family Mustelidae) do not enter into the present account. Their exclusion is only an apparent violation of the unit rule of taxonomic indicators. With but one exception, marine mammals on the generic and supergeneric levels are not elements of the essentially terrestrial Neotropical and Holarctic Regions. They are properly regarded as members of those zones of marine faunal areas (cf. Ekman, 1953) which abut on continental Regions and insular Subregions. The shores where certain marine mammals breed and rear their young are transition zones (see p. 587) between terrestrial and marine faunal areas.

The cetacean *Inia* is the only genus of the aforementioned taxa that is confined to fresh-water habitats in the Western Hemisphere. It is an element of the Brazilian Subregion and is so listed (Table XIII).

The order Sirenia is represented in the Western Hemisphere by two species of the genus *Manatus*. One species, *Manatus manatus*, is an oceanic regionalite excurrent into the Nearctic and Brazilian Subregions. The other, *M. inunguis*, is confined to fresh-water streams and lakes in the Brazilian Subregion.

FAUNAL RESEMBLANCE AND FAUNAL RELATIONSHIP

The degree of *resemblance* between two faunas is measured by the number of taxa common to both. The resemblance can be expressed by the formula $100\ C/N_1$ of Simpson (1947, p. 220; 1953, p. 56). Here C represents the number of taxonomic units (taxa) common to both faunas; N_1 is the total number of taxa in the smaller of the two faunas. The taxon used is the species, genus, family, or any other explicit unit that best expresses the true degree of resemblance. Thus, faunal resemblance between such widely separated Regions as the Neotropical and Australian begins at the family level (Muridae, Canidae, Vespertilionidae, Molossidae). Use of the next higher taxon, the order, simply shows the cosmopolitan nature of the units common to both faunas. In comparing the mammalian faunas of two biotic zones of a Regional subdivision, where ecological differences are great, the species shows resemblance best. Where ecological differences are less, the subspecies may be the proper indicator.

Simpson's formula for expressing the degree of resemblance between two faunas is simple, convenient and accurate. It does not always indicate, however, the real *relationship*. Thus two faunas with C number of cosmopolites and none other, common to both, are related in a different way than they would be if they had only C regionalites in common. A different, more intimate form of relationship is shown by the number of varicants common to both faunas. Other difficulties that arise in the interpretation of the index of resemblance are detailed in another connection (p. 600).

Determination of the kinds of *relationship* between two faunas must be based on an analysis of the cosmopolitan, regional and varicant elements of each of the faunas compared. Holarctic regionalites in the Neotropical fauna and Neotropical regionalites in the Holarctic fauna show a relationship acquired through an interchange of faunal elements. The intensity of faunal flow in either direction is also revealed by this analysis. Varicants, on the other hand, show a relationship based on a natural community of certain forms. There is an interesting sidelight relationship between varicants and excurrent regionalites. The two types are ecologically compatible but the geographic range of excurrents never exceeds that of varicants in the same Region. The kind of relationship shown by the cosmopolites common to the faunas compared depends on the number of cosmopolites that originated in one or the other of the areas concerned, and the number that originated outside the faunal areas in question. All cosmopolites of the Western Hemisphere (Table X) originated in the area now regarded as the Holarctic Region, the vast majority, if not virtually all of them, in what is now the Palearctic Subregion. Thus, cosmopolites common to Nearctica and Neotropica show resemblance but not *relationship* between the two faunal areas. In a comparison between Nearctica and Palearctica the same cosmopolites have the character of regionalites or varicants and reveal relationship as well as resemblance between areas concerned.

THE MAMMALIAN FAUNA OF THE NEW WORLD

Table XIII lists all known living genera of New World mammals by geographic distribution. To facilitate evaluation of the degree of segregation between Holarctic and Neotropical elements at the interregional boundary, the mammals of northern Mexico and those of southern Mexico are listed in separate columns.

The systematic arrangement of Table XIII is by order, family and, in some categories, subfamily. The genera of each hierarchy, however, are grouped in a sequence that reveals distributional patterns.

The principal source of data for North American mammals, compiled up to January 1, 1953, is Miller and Kellogg (1955). Supplementary data in more recent literature, notably the faunal reports by Dalquest (1953) and Baker (1956), have also been taken into account. The source of information for South American forms is my own manuscript check list of the mammals of that continent. Unpublished data from specimens in the collection of Chicago Natural History Museum have also been used.[1]

NEOTROPICA VERSUS NEARCTICA

The Neotropical Region and the Nearctic Subregion are roughly equal in area. The first comprises all South America including the Galapagos and Falkland Islands, the West Indies, Central America and southern Mexico. Insofar as mammals alone are concerned, the Bahamas are regarded as part of the West Indies. The Nearctic Subregion consists of the remainder of North America. The continental boundary between the two faunal areas marks the primitive dividing line between the tropical American climax forest, with its special fauna, on the one hand, and the savannas, scrublands, deserts and temperate zone forests of Mexico, with their characteristic fauna, on the other.

The same continental land masses of the Western Hemisphere in early Tertiary were inhabited by different kinds of mammals likewise segregated into two major faunal areas. The dividing line then between the two areas was at the Isthmus of Panama.

The most striking feature of the Recent Nearctic mammalian fauna (Table II) compared with that of the Neotropical (Table III) is its poverty. It consists of less than one half the number of genera found in Neotropica. Although the data do not appear in the tabulations, Nearctica is even poorer in species and numbers of individuals. In a like manner, the mammalian fauna of the Palearctic Subregion is meager compared with that of the Paleotropical Region.

A second noteworthy character of the Nearctic Subregion is the small proportion of regionalites. Only 41 per cent of the mammals

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[1] Darlington's *Zoogeography: the geographical distribution of animals* (1957) was received while the present paper was in press. This important work includes an excellent summary of what was known of the distribution of Neotropical mammals. However, the detailed distributional data presented in the following pages show that contrary to the belief of most zoogeographers, including Darlington, the Central American mammalian fauna is not transitional and that the greater faunal flow in Recent time is from south to north, not the reverse (cf. Darlington, pp. 339, 461, 474).

TABLE II.—COMPOSITION OF NEARCTIC SUBREGION ACCORDING TO ZOOGEOGRAPHIC TYPES OF LIVING MAMMALS

ZOOGEOGRAPHIC TYPES	GENERA	PER CENT
Nearctic regionalites		
Endemic	47	38.6
Excurrent	3	2.5
Varicants		
Nearctic–Neotropical	16	13.1
Nearctic–Palearctic	17	13.9
Neotropical excurrents	22	18.0
Cosmopolites	17	13.9
Totals	122	100.0

TABLE III.—COMPOSITION OF NEOTROPICAL REGION ACCORDING TO ZOOGEOGRAPHIC TYPES OF LIVING MAMMALS

ZOOGEOGRAPHIC TYPES	GENERA	PER CENT
Neotropical regionalites		
Endemic	236	81.9
Excurrent	22	7.6
Varicants		
Nearctic–Neotropical	16	5.6
Nearctic–Palearctic	1	0.3
Nearctic excurrents	3	1.1
Cosmopolites	10	3.5
Totals	288	100.0

are strictly Nearctic, whether endemic or excurrent. The remainder are nearly evenly divided between cosmopolites, two types of varicants and Neotropical excurrents. In contrast, 89.5 per cent of Neotropical mammalian genera are native. The flow of Neotropical land mammals into Nearctica is increasing while that between Nearctica and Palearctica is virtually static.

The long-time insular nature of the Neotropical Region is attested by its high proportion (81.9 per cent) of endemics. Evidently, establishment of the Pliocene land bridge between South and Central America was merely the closing of a geographical gap between faunal areas already intimately related by over-water colonizations, island hopping, and interchanges via the early Tertiary land bridge. Recent leveling, by man, of ecological barriers between mainland Neotropica and Nearctica is resulting in a southward retreat of the

Regional boundary and the expansion, particularly northward, of the transition zone of mixed faunas.

THE MIDDLE AMERICAN PROVINCE

The Middle American Province extends from the inter-regional boundary in southern Mexico southward through Central America to the southern border of Panama. It continues in South America along the Pacific coastal plain and tropical zone of the western slope of the Cordillera Occidental of Colombia and northern Ecuador. However, for present purposes of comparison, the South American portion is omitted from the faunal area of the Province. This arbitrary measure is used to accentuate the fact that the North American fraction of the Province, as here defined, is distinctly and overwhelmingly Neotropical in substance.

The great variety and numerical abundance of the mammals of the Middle American Province (Table IV) are characteristic of the Brazilian Subregion as a whole. This North American portion of the Province, with less than one-twentieth the area of all Nearctica, contains 11 per cent more genera. Of its 138 genera, 109 (79 per cent) are Neotropical regionalites. Twenty-two of these genera (16 per cent of the total) range into Nearctica. In contrast, only 4 genera of Holarctic mammals, not counting cosmopolites, have passed into the Middle American Province. This last point, more than any other, stresses the nearly complete individuality of the North American fraction of the Middle American Province as compared with the Holarctic region.

There are 11 endemic genera (8 per cent of the total) in the Middle American Province. Except for two genera of bats, these endemics appear to be the residue of an ancient North American fauna that probably ranged well into what is now western United States. A portion of this fauna disappeared without issue. Another part migrated into South America, where it evolved into modern Neotropical species and genera. Of the endemic bats, monotypic *Sturnirops* may prove to be congeneric with the widely spread Neotropical *Sturnira*, and monotypic *Centurio* almost certainly will be found to occur in northwestern South America. The few truly endemic genera and the absence of endemics of higher rank indicate the minor status of Middle America as a faunal area. On the other hand, a significantly high percentage of endemic species, a category not dealt with here, justifies the position of Middle America as a Province of the Brazilian Subregion.

TABLE IV.—COMPOSITION OF NORTH AMERICAN PORTION OF MIDDLE AMERICAN PROVINCE ACCORDING TO ZOOGEOGRAPHIC TYPES OF LIVING MAMMALS

ZOOGEOGRAPHIC TYPES	GENERA	PER CENT
Neotropical Regionalites		
Endemic	11	8.0
Excurrent	22	16.0
Other (see Table V)	76	55.0
Varicants		
Nearctic–Neotropical	16	11.6
Nearctic–Palearctic	1	0.7
Nearctic excurrents	3	2.2
Cosmopolites	9	6.5
Totals	138	100.0

TABLE V.—COMPOSITION OF SOUTH AMERICAN PORTION OF BRAZILIAN SUBREGION ACCORDING TO ZOOGEOGRAPHIC TYPES OF LIVING MAMMALS

Br. = Brazilian Subregion exclusive of its North American portion
M.A. = Middle American Province exclusive of its South American portion
W.I. = West Indian Subregion
Pat. = Patagonian Subregion

ZOOGEOGRAPHIC TYPES		GENERA	GENERA	PER CENT
Neotropical Regionalites				
Endemic			65	33.3
Excurrent			21	10.8
Other			93	47.7
Br.–M.A.		65		
Br.–M.A.–W.I.		7		
Br.–M.A.–Pat.		4		
Br.–M.A.–W.I.–Pat.		0		
Total		76		
Br.–Pat.	15			
Br.–W.I.	2			
Br.–W.I.–Pat.	0			
Varicants (Nearctic–Neotropical)			9	4.6
Nearctic excurrents			0	0.0
Cosmopolites			7	3.6
Totals			195	100.0

MIDDLE AMERICA AND THE BRAZILIAN SUBREGION

The Brazilian Subregion includes the area defined above as the Middle American Province, plus Brazil, Paraguay, northern Corrientes and Misiones in Argentina, the Guianas, Venezuela, Colombia, Trinidad, the islands of Tobago, Margarita, Dutch West Indies and Galapagos, and the originally forested areas of Ecuador, Peru and Bolivia. The transition zone between the Brazilian and Patagonian Subregions extends from southeastern Brazil through Entre Ríos and parts of the Chaco of Argentina, Paraguay and Bolivia; it interdigitates with the alpine and temperate forest zones of Bolivia, Peru and southern Ecuador and overlaps the northern coast of Peru.

Zoogeographers have generally regarded the North American portion of this faunal area as a distinct Subregion with or without the West Indies. A comparison of Tables IV and V shows that the North and South American portions of what here constitutes the Brazilian Subregion are most intimately related. The data may be summarized as follows:

1. There are but 4 Holarctic genera in the North American portion (i.e., the Middle American Province without western Colombia and Ecuador) and they do not filter through into the South American portion of the Subregion.

2. Of 9 cosmopolites in the North American portion, 7 occur in the South American portion.

3. Of 16 Nearctic–Neotropical varicants in the North American portion, 9 occur in the South American portion.

4. Of 22 excurrent Neotropical regionalites, all but one (*Macrotus*) is common to both areas.

5. Of the 76 strictly Neotropical regionalites in the North American portion, all occur in the South American portion of the Brazilian Subregion.

6. Of a total of 138 genera occurring in the North American portion of the Middle American Province, 113 (82 per cent) are common to the South American portion of the Brazilian Subregion.

There is nothing in the mammalian fauna of the Middle American Province to justify the belief that the area is a part of the Nearctic Subregion or even a transition zone between the Neotropical and Holarctic Regions. Even without its South American root in western Colombia and western Ecuador, the mammalian fauna of the area is overwhelmingly Brazilian. It will be shown in a forthcoming paper that the geographically whole Middle American Province is comparable to, and no more distinctive than, other Provinces of the Brazilian Subregion.

THE PATAGONIAN SUBREGION

The Patagonian Subregion includes Uruguay, all of Argentina except Misiones and northern Corrientes, Chile, the alpine highlands of Bolivia, the coast and puna zones of Peru, the *páramos* of Ecuador to the equator, and the Falkland Islands. The transition zone between the Patagonian and Brazilian Subregions has been roughly outlined in the discussion of the latter. The term Patagonian in the sense used here was first proposed by W. L. Sclater (1895, p. 480). Most zoogeographers, beginning with Wallace, have used the name "Chilean" for the Subregion. Unlike Brazil, which is the central and largest part of the Brazilian Subregion, Chile is no more than a provincial part of the Patagonian Subregion. It is advisable, therefore, to restrict the name "Chilean" to the Province that incorporates most of that country.

Endemism in the Western Hemisphere reaches its culmination in the Patagonian Subregion (Table VI). A large part of its mammalian fauna consists of relict marsupials, edentates and hystricomorph rodents. The progressive and dominant Patagonian mammals, however, are the cricetine rodents. Except for the sanguivorous *Desmodus*, all Patagonian bats are insectivorous.

TABLE VI.—COMPOSITION OF PATAGONIAN SUBREGION ACCORDING TO ZOOGEOGRAPHIC TYPES OF LIVING MAMMALS

Br. = Brazilian Subregion exclusive of its North American portion
M.A. = Middle American Province exclusive of its South American portion
Pat. = Patagonian Subregion

ZOOGEOGRAPHIC TYPES	GENERA	GENERA	PER CENT
Neotropical regionalites			
Endemic		43	56.6
Excurrent		6	7.9
Other		19	25.0
Pat.–Br.	15		
Pat.–Br.–M.A.	4		
Varicants (Nearctic–Neotropical)		2	2.6
Nearctic excurrents		0	0.0
Cosmopolites		6	7.9
Totals		76	100.0

THE WEST INDIAN SUBREGION

The West Indian Subregion of the Neotropical Region consists of the chain of islands from the Bahamas and Cuba in the northwest to the Grenadas in the southeast. Little Swan Island with its capromyid rodent (*Geocapromys browni thorocatus*), if it is not an import, may be included.

The living mammalian fauna of the West Indies is small, mostly Neotropical in origin, and preponderantly chiropteran in kind. Its 31 genera of bats, 8 of them endemic, make up 69 per cent of the total fauna. The two genera of Insectivora (*Solenodon* and *Atapogale*) are the most peculiar and ancient of West Indian mammals. The hystricomorphs are the 3 living genera of Capromyidae (*Capromys, Geocapromys, Plagiodontia*), the aguti (*Dasyprocta*) and an arboreal spiny rat (*Echimys*). The capromyids and aguti were important game animals commonly domesticated and carried by man from island to island. The aguti is almost certainly a mainland import. The spiny rats could have been rafted to Martinique from the islands of Trinidad or Margarita, or from the Venezuelan coast. Their habit of nesting in family groups in the hollows of tree trunks and branches lends itself to this form of transportation and to successful colonization. The marmosa (*Marmosa*) of the Grenadines is also a waif or import from Venezuela or its offshore islands. The little rice rat (*Oryzomys antillarum*) of Jamaica is another waif of Central American origin, but accidental importation by man cannot be ruled out. Finally, the opossum (*Didelphis marsupialis*), the armadillo (*Dasypus novemcinctus*) and the raccoon (*Procyon lotor*), all of the Lesser Antilles, are less likely to have been rafted than introduced by man from the mainland. The first two, like the larger hystricomorphs, were (and still are) commonly transported throughout the Neotropical Region as pets, gifts, barter objects, and food. The raccoon, though of the varicant genus *Procyon*, is unquestionably an import from the Nearctic Subregion.

The number of each zoogeographic type of mammal inhabiting the West Indies is shown in Table VII. The index of *resemblance* to the mainland and to each mainland faunal subdivision described in this paper appears in Table VIII. The indices shown do not imply a corresponding degree of *relationship* between the faunas compared. Thus, the 7 genera common to the West Indian and Nearctic Subregions give the figure 16 as the index of resemblance. The genera in question are varicants, cosmopolites, and one Neotropical regionalite equally common to the other faunal areas. If the 7 common

TABLE VII.—COMPOSITION OF WEST INDIAN SUBREGION ACCORDING TO ZOOGEOGRAPHIC TYPES OF LIVING MAMMALS

W.I. = West Indian Subregion
M.A. = Middle American Province exclusive of its South American portion
BR. = Brazilian Subregion exclusive of its North American portion

ZOOGEOGRAPHIC TYPES	GENERA	GENERA	PER CENT
Neotropical regionalites			
Endemic		14	31.1
Excurrent		14	31.1
Other		10	22.2
W.I.–M.A.	1		
W.I.–M.A.–Br.	7		
W.I.–Br.	2		
Varicants (Nearctic–Neotropical)		2	4.4
Nearctic excurrents		0	0
Cosmopolites		5	11.1
Totals		45	99.9

TABLE VIII.—NUMBER OF GEOGRAPHIC TYPES OF LIVING GENERA COMMON TO WEST INDIES AND MAINLAND FAUNAL AREAS

C = Number of genera common to the two faunal areas compared
N = Number of genera in the smaller fauna

ZOOGEOGRAPHIC TYPES	WEST INDIAN SUBREGION	BRAZILIAN SUBREGION	MIDDLE AMERICAN PROVINCE	NEARCTIC SUBREGION
Neotropical		25	24	1
Nearctic		0	0	0
Varicant		2	2	2
Cosmopolitan		3	3	4
Total of common genera (C)		30	29	7
Total of genera in each area	45	195	138	123
Index of resemblance (100 C/N_1)		67	64	16

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genera were West Indian or Nearctic subregionalites instead, the index would remain 16 in spite of the fact that the resemblance would be based on an entirely different sort of relationship. Again, if there were only 50, or as many as 50,000 genera in the Nearctic Subregion, 7 genera common to it and the West Indies would still yield the index 16. Further, whether the 7 genera were distributed among 7 orders, 7 families, or but a single family, the index would persist in registering 16. However the index may be interpreted, the fact remains that there are no strictly Nearctic genera of mammals in the West Indies. There is, therefore, no basis for referring the islands to the Holarctic Region.

The classification of the living mammalian fauna of the West Indies as Neotropical is inescapable. Most of these animals are intimately related to, many specifically identical with, those of either Central or South America, or both. That they resemble South

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TABLE IX.—GENERA OF LIVING AND EXTINCT MAMMALS IN THE GREATER ANTILLES

( ) = Taxa extinct in West Indies
0 = Fossil record
x = Living record

	CUBA	JAMAICA	HISPANIOLA	PUERTO RICO
INSECTIVORA				
Solenodon			x	
Atopogale	x			
(*Nesophontes*)	0		0	0
CHIROPTERA				
Noctilio		x		
Chilonycteris	x	x	x	x
Mormoops	x	x 0	x	
Macrotus	x	x	x	
(*Tonatia*)		0		
Glossophaga		x		
Monophyllus	x	x	x	x
Brachyphylla	x	0	x	
Artibeus	x	x	x	x
Phyllops	x		x	
Ariteus		x 0		
(*Stenoderma*)				0
Erophylla	x	x	x	x
Phyllonycteris	x		0	0
Reithronycteris		x 0		
Natalus	x	x 0	x	
Eptesicus	x	x 0	x	x
Lasiurus	x	x	x	
Dasypterus	x			
Nycticeius	x			
Tadarida	x	x	x	x
Eumops	x	x		
Molossus	x	x	x	x
(PRIMATES)				
(*Xenothrix*)		0		
(EDENTATA)				
(*Acratocnus*)	0		0	0
(*Parocnus*)			0	
(*Megalocnus*)	0		0	
(*Mesocnus*)	0			
(*Microcnus*)	0			

Table IX.—GENERA OF LIVING AND EXTINCT MAMMALS IN THE GREATER ANTILLES (*continued*)

		Cuba	Jamaica	Hispaniola	Puerto Rico
RODENTIA					
Oryzomys			x		
(*Heptaxodon*)					0
(*Elasmodontomys*)					0
(*Clidomys*)			0		
(*Spirodontomys*)			0		
(*Speoxenus*)			0		
(*Quemisia*)				0	
(*Alterodon*)			0		
Capromys		x			
Geocapromys		0	x		
(*Hexolobodon*)				0	
Plagiodontia				x	
(*Isolobodon*)				0	0
(*Aphaetreus*)				0	
(*Brotomys*)				0	
(*Boromys*)		0			
(*Heteropsomys*)					0
(*Homopsomys*)					0
(*Proechimys*)					0
Total extinct	24	7	6	9	10
Total living	27	19	19	15	7

American forms slightly more may be as much the result of chance as is the heterogeneous composition of the fauna as a whole.

The evidence offered by the living native mammals indicates that the West Indies today are probably best defined as a Subregion of the Neotropical Region. The proportion of its endemics, though less than that of other New World Subregions, is still three and one-half times that of the Middle American Province. The endemic families Solenodontidae and Capromyidae and the endemic chiropteran subfamily Phyllonycterinae add weight to the peculiarity of the fauna. Another factor for consideration is that the vital mammalian fauna of the West Indies is not a stage in, or a collateral branch of, faunal successions that have taken place on the American continents. The fauna of the West Indies is an agglomerate of mainland elements transported fortuitously over water or through the air. That these forms should be predominantly Neotropical can be accounted for by accidents of geography and meteorology, and by the ecological similarities of the areas concerned.

Most of the conclusions reached here from a study of extant genera only, are in accord with those drawn by Simpson (1956) based mainly on extinct forms. One important divergence between the views of Simpson and those expressed here relates to the zoogeographic status of the Greater Antilles. The four large islands of this group are Cuba, Jamaica, Puerto Rico and Hispaniola.

While the Greater and Lesser Antilles are herein classified together as the West Indian Subregion of the Neotropical Region, Simpson (1956, pp. 24–25) believes that each island of the Greater Antilles might well be recognized as a distinct zoogeographic Region. However, to avoid complications that would develop from the establishment of a series of new major Regions, one for each island, Simpson elected the alternative of excluding the Greater Antilles from the Regional system altogether.

The viewpoint merits examination in the light of the zoogeographic concepts and classification offered here. The Greater Antillean fauna taken into account by Simpson includes the 21 known genera of extinct non-volant land mammals and the 5 (or 6) genera of living non-volant land mammals. The extinct forms are members of the late Pleistocene-early Recent fauna of the islands. Excepting the rice rat *Oryzomys*, the living non-volant genera are relicts of the same fauna. True, this is a cross section of the animals that occupied the Greater Antilles during the Recent geological epoch, but it is hardly a realistic sampling of the fauna that exists on the islands today. It is not surprising, therefore, that Simpson could not relate this dead and dying fauna with any now living on the mainland. If the origin and means of dispersal of the Greater Antillean mammals are as Simpson states them to be, these animals may be associated with some pre-Recent fauna of the mainland whence they strayed. What the zoogeographic character of the relevant mainland areas of that time may be, is, as Simpson (1956, p. 25) asserts, "an interesting and important point, but it has nothing to do with the descriptive designation of the recent zoogeographic situation." By the same token, what the fauna of the Greater Antilles *was* at one time, even in some not too remote Recent period, is not germane to the zoogeographic classification of the present fauna of the islands.

The living mammalian fauna of the Greater Antilles is predominantly chiropteran (see Table IX, which includes the known fossil forms for completeness). Present and future expansion of the West Indian fauna depends principally on fortuitous over-water and airborne arrivals from contemporary faunal areas of the mainland. This straggling and uncertain method of increment is largely nullified by modern man's systematic leveling of habitats and the progressively intensified persecution of the wild fauna by imported predators. The over-all result is that bats, the most successful colonizers in tropical regions, increase in kind and number, even in urban and cultivated rural localities. At the same time, the more vulnerable, less mobile and transportable non-volant mammals of the islands are diminishing in kind and number to the vanishing point. Because he excluded bats from consideration, Simpson virtually erased the Greater Antilles from the classical zoogeographic map.

The extinct fauna of the West Indies, already fairly well known, continues to be the object of special studies. Unfortunately there is practically no comparative material from the Caribbean coasts of Central and South America of the same and the preceding time periods. In any case, the problem of the geographic classification of the known fragments of an extinct West Indian fauna, some of it Recent, is not the problem of comparing and classifying the whole living mammalian fauna.

SUMMARY

The concepts underlying the present definition of the Neotropical Region are explained. A zoogeographic area, whether Realm, Region or subdivision thereof, is regarded as a faunal district of the earth at a stated time in geologic history. The fauna of a zoogeographic area includes all animals inhabiting that area at the same time irrespective of their place of origin. A zoogeographic boundary between faunal areas is the barrier that prevents a natural and continuous faunal flow from one area to the other. A zoogeographic transition zone is an area on either or both sides of the arbitrarily drawn boundary line between contiguous and contemporaneous faunal areas. Its entire fauna is derived from neighboring areas.

Disregard for the temporal nature of any faunal area is the principal cause for divergent opinions and confusion regarding the zoogeographic definitions of areas, faunas and species.

A zoogeographic terminology for animals, analogous to that used for geographic areas, is introduced for comparative and analytical purposes. The most important zoogeographic types of animals are defined as follows: A *cosmopolite* is a taxon with a geographic range that includes a tropical Region of either the Eastern or Western Hemisphere, and a Holarctic Subregion of the *other* Hemisphere. A *regionalite* is a taxon native to a zoogeographic Region to which it may be confined (*endemic regionalite*) or from which it may spread into another usually contiguous Region (*excurrent regionalite*). *Varicant* is the name applied to a taxon living in two contiguous Regions when it cannot be determined with certainty in which of the Regions that taxon originated. A *visitor* is an individual or group of individuals of a given species, with temporary or non-breeding residence in a Region. An *import* is any form introduced into a foreign area through human agency.

The geographic limits and affinities of a faunal area of a given time may be determined by any one or more of the taxa living in the area at that time. The taxon or taxa selected are zoogeographic indicators. Whatever the indicator, it must include all members of the designated taxon. When the class Mammalia is the indicator, every resident order, family, genus and species must be reckoned. If the species is the taxonomic unit employed, every subspecies and every known locality record must be taken into account.

Interfaunal resemblance as determined by Simpson's formula $100\ C/N_1$ is uncritical and of limited value because it does not show the kind of interfaunal relationship. In the formula, C is the number of taxa common to both faunal areas, and N_1 is the total number of taxa of the smaller fauna. The formula neither distinguishes between zoogeographic types (i.e., cosmopolites, regionalites, visitors, etc.) nor takes into account the systematic hierarchies in which each of the common taxa is contained.

The Neotropical Region in terms of its mammalian fauna is composed of the Brazilian, Patagonian and West Indian Subregions. Southern Mexico and Central America, heretofore combined by most zoogeographers into a fourth Subregion, are here treated as portions of the Middle American Province of the Brazilian Subregion.

The most striking feature of the Nearctic mammalian fauna as compared with that of the Neotropical is its poverty. It consists of less than half the number of genera found in Neotropica. Even the Middle American Province, though less than one-twentieth the area of the Nearctic Subregion, has a richer fauna.

In past geologic epochs, South America derived its fauna from North America. In Recent time, the faunal flow has been nearly entirely reversed. The Holarctic Region has received 22 Neotropical regionalites while the Neotropical Region has but 4 Holarctic (or Nearctic) regionalites. The 16 Nearctic–Neotropical varicants, however, attest to the historical relationships between the geographic areas represented by the modern Regions.

Table I shows the zoogeographic scheme followed here. Tables X–XII list respectively the cosmopolite, excurrent regionalite and varicant genera. Table XIII lists all genera, by geographic areas, of the Nearctic Subregion and the Neotropical Region. Tables II–VII show the number and proportion of cosmopolites, regionalites and varicants in each of the major New World faunal areas. Table VIII compares the West Indian Subregion with mainland faunal areas and reveals the greater resemblance between the former and Neotropica. Table IX lists all known living and extinct mammalian genera for each of the main islands of the Greater Antilles. This makes evident the preponderantly chiropteran and Neotropical nature of the Greater Antillean fauna.

Table X.—DISTRIBUTION OF LIVING COSMOPOLITAN GENERA IN THE NEW WORLD

	Nearctic	Middle American	Brazilian	Patagonian	West Indian
INSECTIVORA					
Soricidae					
Sorex	x				
CHIROPTERA					
Vespertilionidae					
Nycticeius	x				x
Pipistrellus	x	x			
Myotis	x	x	x	x	x
Eptesicus	x	x	x	x	x
Molossidae					
Tadarida	x	x	x	x	x
ARTIODACTYLA					
Cervidae					
Cervus	x				
Bovidae					
Ovis	x				
LAGOMORPHA					
Leporidae					
Lepus	x				
RODENTIA					
Sciuridae					
Sciurus	x	x	x		x
CARNIVORA					
Canidae					
Canis	x	x			
Vulpes	x				
Ursus	x				
Martes	x				
Mustela	x	x	x	x	
Lutra	x	x	x	x	
Felis	x	x	x	x	
Totals	17	9	7	6	5

TABLE XI.—DISTRIBUTION OF NEARCTIC AND NEOTROPICAL EXCURRENT REGIONALITES

Note: The 4 Nearctic excurrents (in **bold face**) range into the Middle American Province; the 22 Neotropical excurrents (in *italics*) range into the Nearctic Subregion.

	NEARCTIC	MIDDLE AMERICAN[1]	BRAZILIAN[2]	PATAGONIAN	WEST INDIAN
MARSUPIALIA					
Didelphidae					
Didelphis	x	x	x	x	x
Marmosa	x	x	x	x	x
CHIROPTERA					
Emballonuridae					
Saccopteryx	x	x	x		
Balantiopteryx	x	x	x		
Desmodontidae					
Desmodus	x	x	x	x	
Natalidae					
Natalus	x	x	x		x
Phyllostomidae					
Artibeus	x	x	x		x
Enchisthenes	x	x	x		
Chilonycteris	x	x	x		x
Pteronotus	x	x	x		x
Mormoops	x	x	x		x
Macrotus	x	x			x
Glossophaga	x	x	x		x
Vespertilionidae					
Dasypterus	x	x	x		x
Rhogeessa	x	x	x		
Molossidae					
Molossus	x	x	x	x	x
Eumops	x	x	x	x	x
EDENTATA					
Dasypodidae					
Dasypus	x	x	x	x	x
RODENTIA					
Sciuridae					
Glaucomys	x	x			
Muridae					
Oryzomys	x	x	x	x	x
Sigmodon	x	x	x		
Microtus[3]	x	x			
CARNIVORA					
Procyonidae					
Nasua	x	x	x		
Mustelidae					
Spilogale	x	x			
Mephitis	x	x			
Felidae					
Herpailurus	x	x	x		
Totals	26	26	21	7	14

[1] North American portion only. [2] South American portion only.

[3] Also a Nearctic-Palearctic varicant (see Tables II–IV, XII).

TABLE XII.—LIST OF NEW WORLD VARICANTS

	NEARCTIC–PALEARCTIC VARICANTS[1]	NEARCTIC–NEOTROPICAL VARICANTS
INSECTIVORA		
Soricidae		
Cryptotis		x
CHIROPTERA		
Vespertilionidae		
Lasiurus		x
Corynorhynus		x
Phyllostomidae		
Choeronycteris		x
Leptonycteris		x
LAGOMORPHA		
Ochotonidae		
Ochotona	x	
Leporidae		
Sylvilagus		x
RODENTIA		
Sciuridae		
Marmota	x	
Spermophilus	x	
Tamias	x	
Heteromyidae		
Liomys		x
Castoridae		
Castor	x	
Muridae		
Peromyscus		x
Reithrodontomys		x
Baiomys		x
Neotoma		x
Dicrostonyx	x	
Lemmus	x	
Clethrionomys	x	
Microtus[2]	x	
CARNIVORA		
Canidae		
Urocyon		x
Alopex	x	
Ursidae		
Thalarctos	x	
Procyonidae		
Procyon		x
Mustelidae		
Gulo	x	
Taxidea	x	
Conepatus		x
Felidae		
Lynx	x	

[1] Nearctic–Palearctic varicants are Holarctic Regionalites.

[2] Also an excurrent Regionalite (see Table XI).

TABLE XII.—LIST OF NEW WORLD VARICANTS (*continued*)

	NEARCTIC–PALEARCTIC VARICANTS	NEARCTIC–NEOTROPICAL VARICANTS
ARTIODACTYLA		
Tayassuidae		
Pecari		x
Cervidae		
Alces	x	
Rangifer	x	
Odocoileus		x
Bovidae		
Bison	x	

TABLE XIII.—DISTRIBUTION OF GENERA OF MAMMALS OF THE WESTERN HEMISPHERE

(As of December, 1956)

No. = North America north of the Mexican boundary
N.M. = Mexico north of the Neotropical–Holarctic boundary
S.M. = Southern Mexican portion of Brazilian Subregion
C.A. = Central American portion of Brazilian Subregion
Br. = South American portion of Brazilian Subregion
Pat. = Patagonian Subregion
W.I. = West Indian Subregion

	HOLARCTIC		NEOTROPICAL					Remarks
	NEARCTIC		BRAZILIAN			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
MARSUPIALIA								
Didelphidae								
Didelphis	x	x	x	x	x	x	x	
Marmosa		x	x	x	x	x	x	
Philander			x	x	x			
Caluromys			x	x	x			Includes *Caluromysiops*
Metachirus				x	x			
Chironectes				x	x			
Monodelphis				x	x			
Glironia					x			
Lutreolina					x	x		
Dromiciops						x		
Notodelphys						x		
Caenolestidae								
Caenolestes					x	x		
Lestoros						x		
Rhyncholestes						x		
INSECTIVORA								
Solenodontidae								
Solenodon							x	
Atopogale							x	=*Solenodon?*
Soricidae								
Blarina	x							
Sorex	x	x						
Microsorex	x	x						
Notiosorex	x	x						
Megasorex		x						
Cryptotis	x	x	x	x	x			
Talpidae								
Neurotrichus	x							
Parascalops	x							
Condylura	x							
Scalopus	x	x						
Scapanus	x	x						

	Holarctic		Neotropical					Remarks
	Nearctic		Brazilian			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
CHIROPTERA								
Emballonuridae								
Saccopteryx		x	x	x	x			
Balantiopteryx		x	x	x	x			
Rhynchiscus			x	x	x			
Peropteryx			x	x	x		x	
Centronycteris			x	x	x			
Diclidurus			x	x	x			
Cormura				x	x			
Cyttarops					x			
Depanycteris					x			
Peronymus					x			
Noctilionidae								
Noctilio			x	x	x		x	
Desmodontidae								
Desmodus			x	x	x	x		
Diphylla			x	x	x			
Diaemus					x			
Natalidae								
Natalus		x	x	x	x		x	
Furipteridae								
Furipterus					x			
Amorphochilus					x			
Phyllostomidae								
Chilonycterinae								
Chilonycteris		x	x	x	x		x	
Pteronotus		x	x	x	x		x	
Mormoops	x	x	x	x	x		x	
Phyllostominae								
Macrotus	x	x	x	x			x	
Micronycteris			x	x	x		x	
Lonchorhina			x	x	x		x	
Mimon			x	x	x			
Phyllostomus			x	x	x			
Trachops			x	x	x			
Chrotopterus			x	x	x			
Vampyrum			x	x	x			
Macrophyllum				x	x			
Tonatia				x	x			
Anthorhina				x	x			
Phylloderma				x	x			
Glossophaginae								
Choeronycteris	x	x	x	x				
Leptonycteris	x	x	x	x				
Glossophaga		x	x	x	x		x	
Anoura			x	x	x			
Choeroniscus			x	x	x			
Hylonycteris			x	x	x			
Lonchophylla				x	x			
Lichonycteris				x	x			
Lionycteris					x			
Lonchoglossa					x			
Platalina					x			
Scleronycteris					x			
Monophyllus							x	

	Holarctic		Neotropical					Remarks
	Nearctic		Brazilian			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
Carolliinae								
Carollia			x	x	x		x	
Rhinophylla					x			
Sturnirinae								
Sturnira			x	x	x		x	
Sturnirops				x				=*Sturnira?*
Corvira					x			=*Sturnira?*
Stenoderminae								
Artibeus		x	x	x	x		x	
Enchisthenes		x	x	x	x			
Uroderma			x	x	x			
Platyrrhinus			x	x	x			Antedates *Vampyrops*
Chiroderma			x	x	x			
Pygoderma			x	x	x			
Centurio			x	x			x	
Vampyrodes				x	x			
Vampyressa				x	x			
Ectophylla				x	x			Includes *Mesophylla*
Vampyriscus					x			
Stenoderma					x		x	
Ametrida					x			
Sphaeronycteris					x			
Brachyphylla							x	
Ardops							x	
Phyllops							x	
Ariteus							x	
Phyllonycterinae								
Erophylla							x	
Phyllonycteris							x	
Reithronycteris							x	
Thyropteridae								
Thyroptera				x	x			
Vespertilionidae								
Lasionycteris	x							
Euderma	x							
Antrozous	x	x						
Nycticeius	x	x					x	
Pizonyx		x						
Corynorhinus	x	x	x					
Idionycteris			x					=*Corynorhinus?*
Pipistrellus	x	x	x	x				
Tomopeas					x			
Rhogeessa		x	x	x	x			Includes *Baeodon*
Dasypterus	x	x	x	x	x		x	
Histiotus					x	x		
Myotis	x	x	x	x	x	x	x	
Eptesicus	x	x	x	x	x	x	x	
Lasiurus	x	x	x	x	x	x	x	
Molossidae								
Tadarida	x	x	x	x	x	x	x	Includes *Mormopterus*
Eumops	x	x	x	x	x	x	x	
Molossus		x	x	x	x	x	x	
Cynomops			x	x	x	x		=*Molossops?*
Promops			x	x	x	x		
Molossops					x	x		

	Holarctic		Neotropical					Remarks
	Nearctic		Brazilian			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
PRIMATES								
Cebidae								
Ateles			x	x	x			
Alouatta			x	x	x			
Cebus				x	x			
Saimiri				x	x			
Aotus				x	x			
Lagothrix					x			
Brachyteles					x			
Oreonax					x			
Pithecia					x			Includes *Chiropotes*
Cacajao					x			
Callicebus					x			
Callimico					x			
Callithrichidae								
Saguinus				x	x			*Saguinus* Hoffmannsegg, 1807, antedates *Marikina* Lesson, 1840, and *Leontocebus* Wagner, 1840.
Leontideus					x			*Leontideus* Cabrera, 1956, for *Leontocebus* authors, not Wagner.
Cebuella					x			
Callithrix					x			
EDENTATA								
Myrmecophagidae								
Tamandua			x	x	x			
Cyclopes			x	x	x			
Myrmecophaga				x	x			
Bradypodidae								
Bradypus				x	x			
Choloepus				x	x			
Dasypodidae								
Dasypus	x	x	x	x	x	x	x	
Cabassous				x	x			
Priodontes					x			
Chaetophractus						x		
Euphractus						x		
Zaedyus						x		
Tolypeutes						x		
Chlamyphorus						x		Includes *Burmeisteria*
LAGOMORPHA								
Ochotonidae								
Ochotona	x							
Leporidae								
Lepus	x	x						
Sylvilagus	x	x	x	x	x			
Romerolagus		x						

	Holarctic		Neotropical					Remarks
	Nearctic		Brazilian			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
RODENTIA								
Aplodontidae								
Aplodontia	x							
Sciuridae								
Sciurillus					x			
Microsciurus				x	x			
Sciurus	x	x	x	x	x		x	
Glaucomys	x	x	x	x				
Syntheosciurus				x				
Cynomys	x	x						
Spermophilus	x	x						
Eutamias	x	x						
Tamiasciurus	x							
Marmota	x							
Tamias	x							
Geomyidae								
Thomomys	x	x						
Geomys	x	x						
Cratogeomys	x	x						Also in high altitudes of S.M.
Zygogeomys		x						
Pappogeomys		x						
Orthogeomys			x	x				
Heterogeomys			x	x				
Macrogeomys				x				
Heteromyidae								
Microdipodops	x							
Perognathus	x	x						
Dipodomys	x	x						
Liomys		x	x	x				
Heteromys			x	x	x			
Castoridae								
Castor	x	x						
Muridae								
Cricetinae								
Oryzomys	x	x	x	x	x	x	x	
Megalomys							x	Extinct?
Lenoxus						x		
Deltamys						x		
Reithrodon						x		
Neotomys						x		
Punomys						x		
Notiomys						x		
Irenomys						x		
Hypsimys						x		
Chelemyscus						x		
Chinchillula						x		
Phyllotis						x		
Euneomys						x		
Galenomys						x		
Andinomys						x		
Eligmodontia						x		
Oxymycterus					x	x		
Holochilus					x	x		
Akodon					x	x		
Scapteromys					x	x		
Calomys					x	x		=*Hesperomys*
Blarinomys					x			

	HOLARCTIC		NEOTROPICAL					Remarks
	NEARCTIC		BRAZILIAN			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
Muridae: Cricetinae (*continued*)								
Thaptomys					x			
Thalpomys					x			
Podoxomys					x			
Microxus					x			
Chilomys					x			
Thomasomys					x			
Rhagomys					x			
Phaenomys					x			
Anotomys					x			
Neusticomys					x			
Daptomys					x			
Ichthyomys					x			
Scolomys					x			
Neacomys				x	x			
Rhipidomys				x	x			
Nectomys				x	x			
Zygodontomys				x	x			
Aporodon			x	x	x			
Tylomys			x	x	x			
Rheomys			x	x	x			
Sigmodon	x	x	x	x	x			
Scotinomys				x				
Ototylomys			x	x				
Nyctomys			x	x				
Baiomys	x	x	x	x				
Neotoma	x	x	x	x				
Peromyscus	x	x	x	x				
Reithrodontomys	x	x	x	x				
Otonyctomys			x					
Haplomylomys	x	x						
Onychomys	x	x						
Teanopus		x						
Nelsonia		x						
Xenomys		x						
Neotomodon		x						
Ochrotomys	x							
Podomys	x							
Microtinae								
Microtus	x	x	x	x				Includes *Orthriomys*, *Herpetomys*, *Pedomys*
Ondatra	x	x						
Neofiber	x							
Pitymys	x							
Lagurus	x							
Synaptomys	x							
Phenacomys	x							
Clethrionomys	x							
Lemmus	x							
Dicrostonyx	x							
Erethizontidae								
Erethizon	x	x						
Coendou			x	x	x			
Chaetomys					x			
Echinoprocta					x			

	HOLARCTIC		NEOTROPICAL					Remarks
	NEARCTIC		BRAZILIAN			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
Caviidae								
Cavia					x	x		
Kerodon					x	x		
Galea						x		
Microcavia						x		
Dolichotis						x		
Pediolagus						x		
Hydrochoeridae								
Hydrochoerus				x	x			
Dinomyidae								
Dinomys					x			
Dasyproctidae								
Dasyprocta			x	x	x		x	
Agouti			x	x	x			=“*Cuniculus Brisson*”
Myoprocta					x			
Chinchillidae								
Lagostomus						x		
Lagidium						x		
Chinchilla						x		
Capromyidae								
Capromys							x	Includes *Procapromys*, an import in Venezuela
Plagiodontia							x	
Geocapromys							x	
Myocastor						x		
Octodontidae								
Octodon						x		
Octodontomys						x		
Octomys						x		=*Tympanoctomys?*
Spalacopus						x		
Aconaeomys						x		
Ctenomyidae								
Ctenomys						x		
Abrocomidae								
Abrocoma						x		
Echimyidae								
Proechimys				x	x			
Hoplomys				x	x			
Euryzygomatomys					x			
Clyomys					x			
Carterodon					x			
Cercomys					x			
Mesomys					x			
Lonchothrix					x			
Isothrix					x			
Diplomys					x			
Dactylomys					x			
Kannabateomys					x			
Thrinacodus					x			
Echimys					x		x	
CETACEA								
Platanistidae								
Inia					x			

	Holarctic		Neotropical					Remarks
	Nearctic		Brazilian			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
CARNIVORA								
Canidae								
Dusicyon					x	x		
Chrysocyon					x			
Atelocynus					x			
Lycalopex					x			
Icticyon				x	x			
Urocyon	x	x	x	x	x			
Canis	x	x	x	x				
Vulpes	x	x						
Alopex	x							
Ursidae								
Thalarctos	x							
Ursus	x	x						Includes *Euarctos*
Tremarctos					x			
Procyonidae								
Bassariscus	x	x						
Procyon	x	x	x	x	x		x	
Nasua	x	x	x	x	x			
Jentinkia			x	x				
Potos			x	x	x			
Bassaricyon				x	x			
Mustelidae								
Lyncodon						x		
Galictis			x	x	x	x		Includes *Grisonella*
Conepatus	x	x	x	x	x	x		
Lutra	x	x	x	x	x	x		
Mustela	x	x	x	x	x	x		Includes *Grammogale*
Eira			x	x	x			
Pteronura					x			
Mephitis	x	x	x	x				
Spilogale	x	x	x					
Taxidea	x	x						
Gulo	x							
Martes	x							
Felidae								
Felis	x	x	x	x	x	x		
Herpailurus	x	x	x	x	x			
Lynx	x	x						
SIRENIA								
Manatidae								
Manatus					x			Part, *M. inunguis* only

	Holarctic		Neotropical					Remarks
	Nearctic		Brazilian			Pat.	W.I.	
	No.	N.M.	S.M.	C.A.	Br.			
PERISSODACTYLA								
Tapiridae								
Tapirus			x	x	x			
ARTIODACTYLA								
Tayassuidae								
Pecari	x	x	x	x	x			
Tayassu			x	x	x			
Cervidae								
Cervus	x							
Alces	x							
Rangifer	x							
Odocoileus	x	x	x	x	x			
Mazama			x	x	x			
Blastocerus					x	x		
Blastoceros					x	x		=*Ozotoceros*
Pudu					x	x		Includes *Pudella*
Hippocamelus						x		
Antilocapridae								
Antilocapra	x	x						
Bovidae								
Bison	x	x						Now extinct in N.M.
Ovis	x	x						
Oreamnos	x							
Ovibos	x							
Camelidae								
Lama						x		
Vicugna						x		

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